Amabel Consilvio

1. Formal Proofs

#1	1. p	"Assume"
	2 $p \to q$	" "
	3 $p \to r$	" "
	4 q	2, MP
	5 r	3, MP
	6 $q \wedge r$	4,5, Conjunction
	7 $p \to q \wedge r$	1

#2	1 $p \to q \vee r$	"Assume"
	2 $p \to q \vee \sim r$	" "
	3 p	" "
	~~4 q~~	~~3, 2, MT~~
	4. $q \vee r$	1, MT
	5 $q \vee \sim r$	2, MT
	6 $(q \vee r) \wedge (q \vee \sim r)$	4,5, conjunction
	7 $q \vee (r \wedge \sim r)$	6, distributive
	8 $q \vee F$	7, negation
	9 q	8, identity
	10 $p \to q$	3

$p \to q$

#2

p	q	r	$p \to q$	$q \to r$	$\overset{A}{(p\to q) \land (q \to r)}$	$\overset{B}{p \to r}$	$A \to B$
0	0	0	1	1	1	1	1
0	0	1	1	1	1	1	1
0	1	0	1	0	0	1	1
0	1	1	1	1	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	1	0	1	1
1	1	0	1	0	0	0	1
1	1	1	1	1	1	1	1

tautology

#3

p	q ~~r~~	$p \to q$	$(p \to q) \to p$
0	0	1	0
0	1	1	0
1	0	0	1
1	1	1	1

satisfiable

#4

p	q	r	$\bar{p}$	$\bar{q}$	$\bar{r}$	$\overset{A}{p \lor q \lor r}$	$\overset{B}{\bar{p} \lor \bar{q} \lor \bar{r}}$	$\overset{F}{A \land B}$	$\overset{C}{p \lor \bar{q}}$	$\overset{D}{q \lor \bar{r}}$	$\overset{E}{r \lor \bar{p}}$	$\overset{G}{C \land D \lor E}$	$F \land G$
0	0	0	1	1	1	0	1	0	1	1	1	1	1
0	0	1	1	1	0	1	1	1	1	0	1	1	1
0	1	0	1	0	1	1	1	1	0	1	1	1	1
0	1	1	1	0	0	1	1	1	0	1	1	1	1
1	0	0	0	1	1	1	1	1	1	1	0	1	1
1	0	1	0	1	0	1	1	1	1	0	1	1	1
1	1	0	0	0	1	1	1	1	1	1	0	1	1
1	1	1	0	0	0	1	0	0	1	1	1	1	1

tautology

#2

1)

p	q	r	q ∧ r
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

2)

~r	p	q	r	q∨r (A)	q∨~r (B)	A∧B	q∨(q∧~r)
1	0	0	0	0	1	0	0
0	0	0	1	1	1	1	0
1	0	1	0	1	1	1	1
0	0	1	1	1	1	1	1
1	1	0	0	0	1	0	0
0	1	0	1	1	1	1	0
1	1	1	0	1	1	1	1
0	1	1	1	1	1	1	1

#3

p	q	r	p∧q	p∧q∧r	p∨q	(p∧q∧r)→(p∨q)
0	0	0	0	0	0	1
0	0	1	0	0	0	1
0	1	0	0	0	1	1
0	1	1	0	0	1	1
1	0	0	0	0	1	1
1	0	1	0	0	1	1
1	1	0	1	0	1	1
1	1	1	1	1	1	1

tautology

IV

$$p \vee (q \wedge \sim(r \wedge (s \to t)))$$

$$s \to t = (s \wedge t) \vee \sim s$$

$$p \vee (q \wedge \sim(r \wedge ((s \wedge t) \vee \sim s)))$$

demorgans

↓

$$p \vee (q \wedge ((\sim r) \vee (\sim((s \wedge t) \vee \sim s)))$$

demorgans / double negative

↓

$$p \vee (q \wedge ((\sim r) \vee (\sim(s \wedge t) \wedge s)))$$

$$\boxed{p \vee (q \wedge ((\sim r) \vee (((\sim s) \vee (\sim t)) \wedge s)))}$$

demorgans

V $p = 1$, any therefore anything else will be true because p is or'd wit the rest of the statement.